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## **Long Beach Airport (LGB)**

Air Quality Improvement Plan  
2017 Emissions Inventory  
Final

Prepared for:

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# Section 1

## LGB 2017 Air Quality Improvement Plan Emissions Inventory

### 1.1 Introduction

The City of Long Beach (City) prepared this baseline emissions inventory for Long Beach Airport (LGB) as a starting point for the Air Quality Improvement Plan (AQIP) that will be negotiated with the South Coast Air Quality Management District (SCAQMD) through a memorandum of understanding (MOU). In addition, the City is preparing future emission inventories for the airport that will show the estimated Business-As-Usual (BAU) emissions in 2023 and 2031. Each inventory has been prepared using the most accurate information available to the City concerning airport activity and associated emissions of criterial pollutants and greenhouse gases for the AQIP analysis years.

### 1.2 Summary of AQIP Emissions Inventory

A summary of the LGB 2017 AQIP emissions inventory is presented in **Table 1**.<sup>1</sup> The emissions by major source categories are shown graphically on **Figure 1**. The remaining sections of this report provide an overview of the input parameters and assumptions used to develop this inventory. Detailed information and data are provided in the Appendices.

**Table 1. LGB 2017 AQIP Emissions Inventory**

Airport Emissions Source	Pollutant Emissions, tons per year						
	CO	VOC	NOx	SOx	PM-10	PM-2.5	CO <sub>2</sub> (MT/yr)
<b>Ground Support Equipment Total</b>	<b>110.28</b>	<b>2.55</b>	<b>16.78</b>	<b>0.02</b>	<b>0.65</b>	<b>0.58</b>	<b>2,142</b>
<b>Traffic and Parking</b>							
Regional Traffic	514.80	50.42	49.55	0.99	13.72	5.84	90,897
On-Airport Roadways & Parking Lots	19.87	1.99	2.25	0.04	0.54	0.23	3,592
Paved Road Dust Total	--	--	--	--	26.79	6.70	--
<b>Traffic and Parking Total</b>	<b>534.67</b>	<b>52.41</b>	<b>51.80</b>	<b>1.03</b>	<b>41.05</b>	<b>12.77</b>	<b>94,489</b>
<b>Construction Total</b>	<b>2.30</b>	<b>0.36</b>	<b>2.91</b>	<b>&lt;0.01</b>	<b>0.31</b>	<b>0.20</b>	<b>336</b>
<b>GRAND TOTAL</b>	<b>647.25</b>	<b>55.32</b>	<b>71.49</b>	<b>1.05</b>	<b>42.01</b>	<b>13.55</b>	<b>96,967</b>

Totals may not add exactly due to rounding.

<sup>1</sup> Emissions of criteria pollutants (carbon monoxide, CO; volatile organic compounds, VOC, oxides of nitrogen, NOx, sulfur oxides, SOx, respirable particulate matter, PM-10; and fine particulate matter, PM-2.5) and the major greenhouse gas pollutant carbon dioxide (CO<sub>2</sub>) are presented in this report. Criteria pollutant emissions are presented in short tons per year, while CO<sub>2</sub> emissions are presented in metric tons (tonnes) per year.

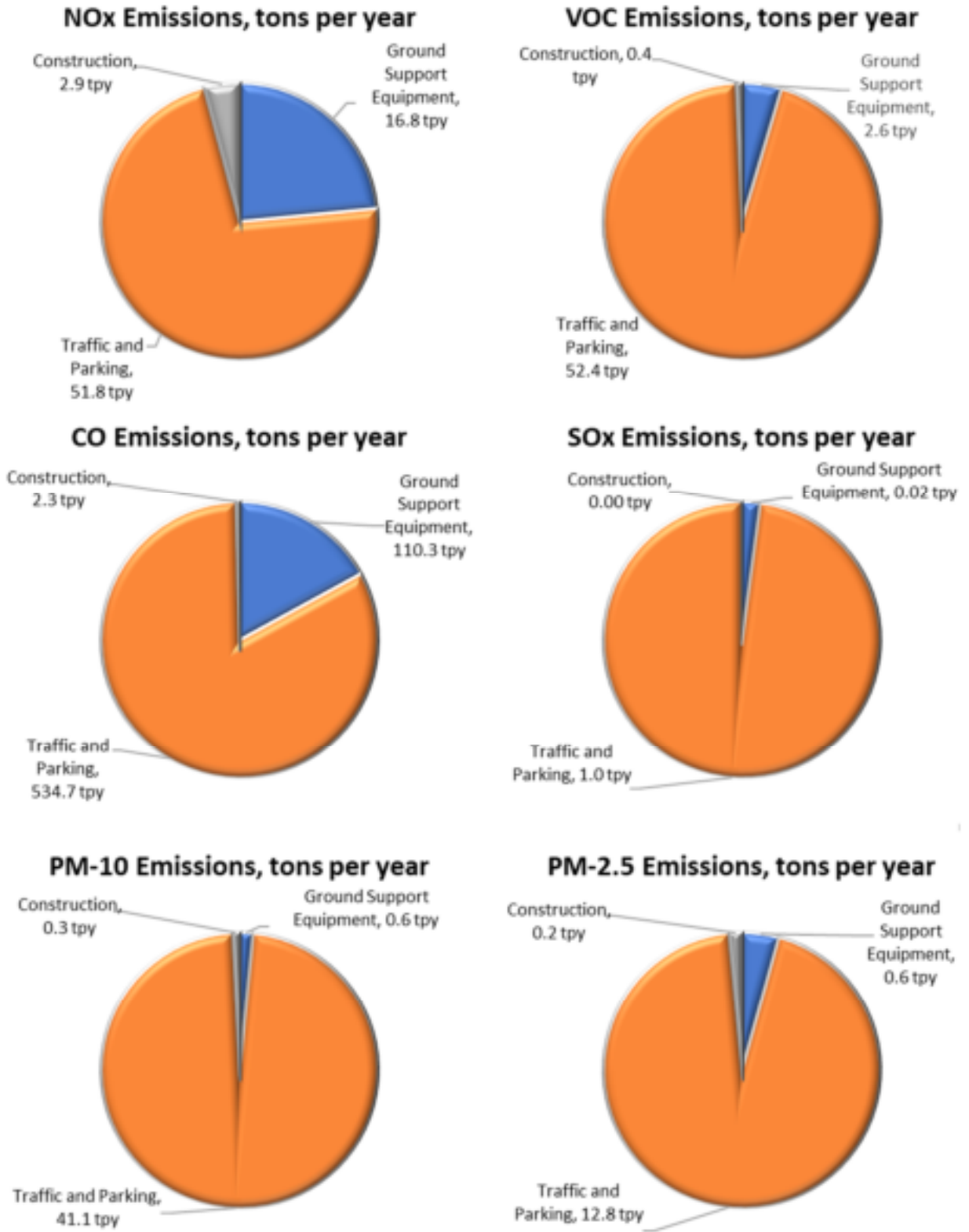


Figure 1. LGB 2017 Baseline AQIP Emissions by Major Source Category

## Section 2

# LGB 2017 Ground Support Equipment Emissions Inventory

## 2.1 GSE Inventory, Activity, and Emissions Modeling

Ground support equipment (GSE) at airports includes the vehicles and equipment that service aircraft at the gates, as well as certain equipment used to maintain the airfield. In early 2019, the City in collaboration with Airlines for America (A4A) and other airport stakeholders, conducted a survey of the GSE operating at LGB. The results of that survey allowed the development of airport-wide GSE inventory by equipment type, equipment age, and fuel type, and was assumed to be representative of the GSE fleet in 2017. The data collected for this inventory (equipment counts) is summarized in **Table 2**. Approximately 40 percent of the GSE operating at LGB is electric powered.

**Table 2. LGB 2017 GSE Inventory of Equipment by Fuel Type**

Equipment Type	Fuel Type			Totals
	Diesel	Gasoline	LPG/Propane	
Air Conditioner	3	0	0	8
Air Start	6	2	0	8
Aircraft Tug	13	4	0	33
Bag Tug	0	9	1	34
Belt Loader	4	4	0	27
Cargo Loader	6	1	0	7
Cargo Tractor	1	7	0	18
Golf Cart	1	4	0	20
Fork Lift	3	0	11	16
GPU	41	1	0	69
Lavatory Cart	0	1	0	4
Lavatory Truck	0	1	0	1
Lift	30	1	0	34
Other GSE	6	9	0	16
Passenger Stairs	0	1	0	1
Fuel Truck	13	5	0	18
Service Truck	0	5	0	5
Sweeper	0	0	0	3
<b>Total</b>	<b>127</b>	<b>55</b>	<b>12</b>	<b>322</b>

Source: CDM Smith, 2019

The California Air Resources Board (ARB) OFFROAD20172 model was used to obtain GSE emission factors, deterioration factors, load factors, and activity levels (hours/year/unit). OFFROAD2017 emission factors were obtained by selecting the following options from the model menu: Los Angeles Sub Area of the South Coast Air Basin; 2017 Calendar Year; Adopted Rules – Exhaust Scenario; All Equipment Types; All Model Years; All Horsepower Bins; and All Fuel Types.

The GSE survey conducted for the 2017 calendar year obtained sufficient manufacture data for equipment such that equipment ages could be determined for most equipment. Aged emission factors were determined for each piece of equipment in the inventory, and load factors and activity levels were applied to create the emission inventory. Each GSE was matched to OFFROAD2017 equipment types based on the designated Fuel Types and Equipment Types. LPG/Propane GSE was assumed to be equivalent to Natural Gas equipment as listed in the OFFROAD database. When possible, the Equipment Categories AirGrSupp and OFF – AirGrSupp were utilized to pair non-diesel equipment, although Portable Equipment, Light Commercial, or other OFFROAD categories were necessary pairings for Pumps or Generator Sets. The full pairing is listed below in **Table 3**.

**Table 3. LGB GSE Type Pairing with OFFROAD2017 Equipment and Fuel Types**

GSE Cat	OFFROAD Cat (Diesel)	OFFROAD Cat (Gasoline & Nat Gas)
Air Conditioner	Portable Equipment - Non-Rental Generator	OFF - AirGrSupp - Air Conditioner
Air Start	Portable Equipment - Non-Rental Generator	OFF - AirGrSupp - Air Start Unit
Aircraft Tug	AirGrSupp - A/C Tug Narrow Body	OFF - AirGrSupp - A/C Tug Narrow Body
Backhoe	ConstMin - Tractors/Loaders/Backhoes	ConstMin - Tractors/Loaders/Backhoes
Bag Tug	AirGrSupp - Baggage Tug	OFF - AirGrSupp - Baggage Tug
Belt Loader	AirGrSupp - Belt Loader	OFF - AirGrSupp - Belt Loader
Cargo Loader	AirGrSupp - Cargo Loader	OFF - AirGrSupp - Cargo Loader
Cargo Tractor	AirGrSupp - Cargo Tractor	OFF - AirGrSupp - Cargo Tractor
Fork Lift	AirGrSupp - Forklift	OFF - AirGrSupp - Forklift
Fuel Truck	AirGrSupp - Other GSE	OFF - AirGrSupp - Fuel Truck
Generator	Portable Equipment - Non-Rental Generator	OFF - AirGrSupp - Generator
Golf Cart	Portable Equipment - Non-Rental Generator	OFF - AirGrSupp - Cart
GPU	AirGrSupp - Other GSE	OFF - AirGrSupp - Ground Power Unit
Lavatory Cart	AirGrSupp - Other GSE	OFF - AirGrSupp - Lav Cart
Lavatory Truck	AirGrSupp - Other GSE	OFF - AirGrSupp - Lav Truck
Lift	AirGrSupp - Lift	OFF - AirGrSupp - Lift
Other GSE	AirGrSupp - Other GSE	OFF - AirGrSupp - Other GSE
Passenger Stairs	AirGrSupp - Passenger Stand	OFF - AirGrSupp - Passenger Stand
Push Back	AirGrSupp - A/C Tug Narrow Body	OFF - AirGrSupp - A/C Tug Narrow Body
Service Truck	AirGrSupp - Other GSE	OFF - AirGrSupp - Service Truck
Skid Steer Loader	ConstMin - Skid Steer Loaders	ConstMin - Skid Steer Loaders
Sweeper	ConstMin - Sweepers/Scrubbers	OFF - AirGrSupp - Sweeper

Source: CDM Smith, 2019

<sup>2</sup> California Air Resources Board. 2017. OFFROAD2017 Web Database. Available at: <https://www.arb.ca.gov/orion/> (accessed February 13, 2019); and California Air Resources Board. 2017. 2017 Off-Road Diesel Emission Factor Update for NOx and PM. Available at: [https://www.arb.ca.gov/msei/ordiesel/ordas\\_ef\\_fcf\\_2017.pdf](https://www.arb.ca.gov/msei/ordiesel/ordas_ef_fcf_2017.pdf) (accessed February 13, 2019).



Based on its category and fuel type, each piece of equipment was matched to the nearest model year and horsepower pairings available in the OFFROAD database. When matching horsepower, the lowest horsepower bin that was greater than the identified horsepower was utilized. When no such horsepower bin existed for the specific category / fuel type pairing, the highest horsepower bin that was smaller than the identified horsepower was utilized. If the model year was missing, the average model year of the same type of equipment (bag tug, belt loader, etc.) at LGB was used.

In airport-provided equipment lists, some GSE lacked identifying model years and/or engine horsepower ratings. In this case, equipment was conservatively paired to the oldest model year equipment for the category / fuel type pairing identified in the OFFROAD database. Horsepower ratings were somewhat more subjective, utilizing either a horsepower-hours per year-weighted average horsepower for the equipment type /fuel type pairing or an estimated horsepower rating based high conformity of horsepower ratings for other GSE of the same category used on the airfield.

## 2.2 GSE Emissions Modeling Results

The emission calculation results for LGB 2017 GSE by equipment type are presented in **Table 4**. **Table 5** summarizes the emissions for GSE by fuel type.

**Table 4. GSE Emissions by Equipment Type at LGB in 2017**

GSE Type	Equipment Count	Pollutant Emissions, tons per year						CO2 Tonnes/yr
		CO	VOC	NOx	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	
Air Conditioner	8	0.376	0.034	0.370	0.000	0.024	0.022	46
Air Start	8	0.664	0.025	0.292	0.000	0.010	0.009	46
Aircraft Tug	33	6.783	0.396	3.230	0.003	0.090	0.082	252
Bag Tug	34	29.538	0.377	1.832	0.003	0.020	0.015	280
Belt Loader	27	7.817	0.142	0.683	0.001	0.034	0.030	81
Cargo Loader	7	0.383	0.043	0.583	0.001	0.029	0.027	66
Cargo Tractor	18	15.434	0.145	0.775	0.001	0.012	0.009	157
Golf Cart	20	3.103	0.045	0.046	0.000	0.003	0.002	6
Fork Lift	16	0.817	0.005	0.275	0.000	0.005	0.004	52
GPU	69	6.313	0.274	3.627	0.005	0.154	0.141	489
Lavatory Cart	4	0.705	0.011	0.010	0.000	0.001	0.000	1
Lavatory Truck	1	1.221	0.011	0.108	0.000	0.003	0.002	32
Lift	34	2.287	0.300	1.773	0.002	0.152	0.140	161
Other GSE	16	28.284	0.575	1.388	0.003	0.044	0.038	266
Passenger Stairs	1	0.035	0.000	0.003	0.000	0.000	0.000	1
Fuel Truck	18	0.807	0.124	1.273	0.001	0.058	0.053	50
Service Truck	5	5.714	0.041	0.516	0.002	0.013	0.010	155
Sweeper	3	0.000	0.000	0.000	0.000	0.000	0.000	0
<b>TOTALS</b>	<b>322</b>	<b>110.281</b>	<b>2.550</b>	<b>16.785</b>	<b>0.022</b>	<b>0.650</b>	<b>0.583</b>	<b>2,142</b>

Source: CDM Smith 2019

**Table 5. GSE Emissions by Fuel Type at LGB in 2017**

Fuel Type	Equipment Count	Pollutant Emissions, tons per year						CO2
		CO	VOC	NOx	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	Tonnes/yr
Diesel	127	6.527	0.978	9.494	0.010	0.559	0.515	937
Gasoline	55	101.465	1.572	6.846	0.013	0.091	0.069	1,134
Propane	12	2.289	0.000	0.444	0.000	0.000	0.000	71
Electric	128	--	--	--	--	--	--	--
<b>TOTALS</b>	<b>322</b>	<b>110.281</b>	<b>2.550</b>	<b>16.785</b>	<b>0.022</b>	<b>0.650</b>	<b>0.583</b>	<b>2,142</b>

Source: CDM Smith 2019

## Section 3

# LGB 2017 Traffic and Parking Emissions Inventories

### 3.1 Traffic and Parking Volumes and Miles Traveled

Ground vehicles trips, including passenger cars, taxis, limos, shuttles, buses, and cargo trucks, traveling to or from LGB were estimated for 2017. The basis for total airport trip estimates was the Long Beach Airport Terminal Area Improvements Project EIR. The Ground Transportation Study Phase II, conducted by InterVISTAS Consulting for Long Beach Airport, provided additional ground access travel mode split information.<sup>3</sup> Consistent with other regional airports, an average passenger-trip distance of 20 miles was assumed for passengers traveling to and from the airport by means of private transportation. A distance of 5 miles was assumed for other vehicle trips, such as those associated with commercial courtesy vehicles or other airport-fleet vehicles.

The types of vehicles traveling to and from each trip end-point were segregated into light duty public vehicles (LDA, LDT1, and LDT2); medium duty commercial vehicles (MDV); and light heavy-duty commercial vehicles (LHD1 and LHD2) technology categories in the CARB EMFAC model. The types of vehicular traffic with assigned EMFAC vehicle categories are presented in **Table 6**.

**Table 6. LGB Traffic Breakdown**

Traffic Category	Percent of Traffic	Average Trip Distance	EMFAC Vehicle Category
Private Vehicles	70.88%	20 miles *	LDA/LDT1/LDT2 EMFAC Mix **
Public Transit Vehicles	0.00%	-	-
Other Vehicles ***	1.98%	5 miles ****	LHD2
Taxicabs	9.64%	20 miles *	LDA/LDT1/LDT2 EMFAC Mix **
Limousines	0.11%	20 miles *	LDA/LDT1/LDT2 EMFAC Mix **
TNCs	15.01%	20 miles *	LDA/LDT1/LDT2 EMFAC Mix **
Shared-ride Vans	0.82%	20 miles *	MDV
Hotel/motel courtesy vehicles	1.11%	5 miles ****	MDV
Off-airport parking courtesy vehicles	0.39%	5 miles ****	LHD1
Off-airport rental car courtesy vehicles	0.07%	5 miles ****	LHD1

\* Miles per trip based on comparable passenger trip distances from other South Coast airports.

\*\* VMT-weighted average of EMFAC fleet mix for specified EMFAC vehicle categories

\*\*\* Includes Airport vehicles, police, maintenance, and delivery vehicles.

\*\*\*\* Miles per trip assumed to be 1/4 normal passenger trip distance.

Actual passenger numbers, combined with per-passenger trip generation data, were used to calculate total annual vehicle trips associated with airport activity. These trips were then broken down by transit mode. The total number of trips for vehicles traveling to and from LGB in 2017 is presented in **Table 7**.

<sup>3</sup> Long Beach Airport, 2017. Update of Ground Transportation at the Long Beach Airport. Available at: <http://www.longbeach.gov/globalassets/city-manager/media-library/documents/memos-to-the-mayor-tabbed-file-list-folders/2017/august-1--2017---update-of-ground-transportation-at-the-long-beach-airport> (accessed April 1, 2019).

**Table 7. Estimated Total Vehicle Trips to LGB in 2017**

Transit Mode		Annual Vehicle Trips to or from LGB
Private Vehicles	Includes passengers driving self as well as pick-up/drop-offs	9,494,300
<b>Subtotal Light Duty Public Vehicles (LDA + LDT1 + LDT2)</b>		<b>9,494,300</b>
Light Commercial	Taxi	1,291,474
Light Commercial	Limousines	14,824
Light Commercial	TNC	2,010,405
<b>Subtotal Light Duty Commercial Vehicles (LDA + LDT1 + LDT2)</b>		<b>3,316,703</b>
Medium Commercial	Shared-ride Vans	109,232
Medium Commercial	Hotel/motel courtesy vehicles	148,232
<b>Subtotal Medium Duty Commercial Vehicles (MDV)</b>		<b>257,555</b>
Light-Heavy Duty Commercial	Off-airport parking courtesy vehicles (LHD1)	51,883
Light-Heavy Duty Commercial	Off-airport rental car courtesy vehicles (LHD1)	9,262
Light-Heavy Duty Commercial	Other Airport vehicles, including maintenance, police, and delivery vehicles (LHD2)	264,967
<b>Subtotal Light-Heavy Duty Commercial Vehicles (LHD1 + LHD2)</b>		<b>326,112</b>

Source: CDM Smith 2019

In lieu of detailed passenger polling data, which was unavailable at the time of this report, an average trip distance traveled for passengers traveling to and from the airport was estimated to be consistent with other local airports. The trip volumes were multiplied by this weighted average trip distance of 20 miles per trip for all transit modes except for commercial courtesy vehicles and other airport vehicles, which were estimated at 5 miles per trip. The resulting annual VMT for each transit mode is presented in **Table 8**.

**Table 8. Regional Miles Traveled for All Trips to or from LGB in 2017**

Transit Mode		Total Annual Vehicle Miles Traveled to or from LGB
Private Vehicles	Includes passengers driving self as well as pick-up / drop-offs	189,886,000
<b>Subtotal Light Duty Public Vehicles (LDA + LDT1 + LDT2)</b>		<b>189,886,000</b>
Light Commercial	Taxi	25,829,480
Light Commercial	Limousines	296,480
Light Commercial	TNC	40,208,100
<b>Subtotal Light Duty Commercial Vehicles (LDA + LDT1 + LDT2)</b>		<b>66,334,060</b>
Medium Commercial	Shared-ride Vans	2,186,460
Medium Commercial	Hotel/motel courtesy vehicles	741,160
<b>Subtotal Medium Duty Commercial Vehicles (MDV)</b>		<b>2,927,620</b>
Light-Heavy Duty Commercial	Off-airport parking courtesy vehicles (LHD1)	259,415
Light-Heavy Duty Commercial	Off-airport rental car courtesy vehicles (LHD1)	46,310
Light-Heavy Duty Commercial	Other Airport vehicles, including maintenance, police, and delivery vehicles (LHD2)	1,324,835
<b>Subtotal Light-Heavy Duty Commercial Vehicles (LHD1 + LHD2)</b>		<b>1,630,560</b>

Source: CDM Smith 2019

## 3.2 On-Airport Roadways and Parking Lots

Using the trip volumes in Table 5, distances traveled on airport roadways and in airport parking lots was estimated to be approximately 0.75 miles per one-way trip for all transit modes. This estimated

distance was developed from reviewing airport roadways and parking lots in Google Earth Pro. The resulting total distance traveled is summarized in **Table 9**.

**Table 9. On-Airport Miles Traveled for All Trips to or from LGB in 2017**

Transit Mode		Total Annual Vehicle Miles Traveled On-Airport at LGB
Private Vehicles	Includes passengers driving self as well as pick-up / drop-offs	7,120,725
<b>Subtotal Light Duty Public Vehicles (LDA + LDT1 + LDT2)</b>		<b>7,120,725</b>
Light Commercial	Taxi	968,606
Light Commercial	Limousines	11,118
Light Commercial	TNC	1,507,804
<b>Subtotal Light Duty Commercial Vehicles (LDA + LDT1 + LDT2)</b>		<b>2,487,527</b>
Medium Commercial	Shared-ride Vans	81,992
Medium Commercial	Hotel/motel courtesy vehicles	111,174
<b>Subtotal Medium Duty Commercial Vehicles (MDV)</b>		<b>193,166</b>
Light-Heavy Duty Commercial	Off-airport parking courtesy vehicles (LHD1)	38,912
Light-Heavy Duty Commercial	Off-airport rental car courtesy vehicles (LHD1)	6,947
Light-Heavy Duty Commercial	Other Airport vehicles, including maintenance, police, and delivery vehicles (LHD2)	198,725
<b>Subtotal Light-Heavy Duty Commercial Vehicles (LHD1 + LHD2)</b>		<b>244,584</b>

Source: CDM Smith 2019

### 3.4 LGB Traffic and Parking Emissions Inventories

Emission factors from the ARB EMFAC2017 model were used to estimate traffic and parking lot emissions. Emission factors were aggregated by speed and by model years were obtained for all technology categories. The light duty vehicle factors were developed from distance traveled (VMT)-weighted averages of the LDA, LDT1 and LDT2 vehicle types. Medium duty vehicle (MDV) and light-heavy duty vehicle (LHD) factors were developed from EMFAC default values.

The emission factors were developed from EMFAC2017 emission inventories for the South Coast Air Basin portion of Los Angeles County for calendar year 2017. The total pollutant emission inventories (in tons per day) for each of the vehicle technology categories noted above (LDA, LDT1, LDT2, MDV, LHD1, and LHD2) were divided by the EMFAC VMT data for the corresponding vehicle technology category. The final 2017 emission factors, in grams per mile, for each pollutant are summarized in **Table 10**. In addition, re-entrained road dust was estimated the method described in Chapter 13.2.1 Paved Roads in U.S. EPA's Compilation of Air Pollutant Emission Factors (AP-42).

**Table 10. 2017 Emission Factors from EMFAC2017**

Vehicle Category	2017 Calendar Year Emission Factors, grams/mile						
	CO	VOC	NOx	SOx	PM10	PM2.5	CO2e
LDAT <sup>a</sup>	1.781	0.173	0.161	0.003	0.047	0.020	344
MDV <sup>b</sup>	2.751	0.272	0.313	0.005	0.048	0.020	504
LHD1 <sup>c</sup>	2.090	0.483	1.365	0.007	0.094	0.043	760
LHD2 <sup>d</sup>	1.429	0.358	1.878	0.007	0.113	0.054	770
Paved Road	--	--	--	--	0.090	0.022	--
Dust	--	--	--	--	0.090	0.022	--

Source: CDM Smith 2019.

- a. LDAT = Light Duty Autos and Trucks. Emission factors developed from LDA, LDT1, and LDT2 total emissions (South Coast portion of Los Angeles County in 2017).
- b. MDV = Medium Duty vehicles. Emission factors developed from MDV total emissions (South Coast portion of Los Angeles County in 2017).
- c. LHD1 = Light-Heavy Duty vehicles. Emission factors developed from LHD1 total emissions (South Coast portion of Los Angeles County in 2017).
- d. LHD2 = Light-Heavy Duty vehicles. Emission factors developed from LHD2 total emissions (South Coast portion of Los Angeles County in 2017).

The LGB 2017 total traffic emission inventories are summarized in **Table 11**.

**Table 11. Grand Total - LGB Traffic Emissions**

Airport Destination	Pollutant Emissions, tpy						CO <sub>2</sub> e MT/yr
	CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	
<b>Regional Emissions</b>	514.795	50.420	49.545	0.991	13.717	5.843	90,897
<b>On-Airport Traffic &amp; Parking Emissions</b>	19.872	1.993	2.247	0.039	0.541	0.231	3,592
<b>Paved Road Dust</b>	--	--	--	--	26.786	6.696	--
<b>TOTAL Traffic-Related Emissions</b>	<b>534.667</b>	<b>52.413</b>	<b>51.792</b>	<b>1.030</b>	<b>41.044</b>	<b>12.771</b>	<b>94,488</b>

Source: CDM Smith 2019.

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## Section 4

# LGB 2017 Construction Source Emissions Inventory

### 4.1 Construction Emission Documents

In 2017, routine maintenance and minor improvements occurred on and around the Long Beach Airport (LGB). No major construction activity, such as the upcoming Phase II of the LGB Terminal Area Improvements, occurring during the baseline year, 2017. For the 2017 baseline, descriptions of routine maintenance and minor airport improvements were provided by the airport and emission estimates were made to account for this activity.

Emissions were calculated using the California Emission Estimator Model (CalEEMod) version 2016.3.2. The model can be accessed at <http://www.caleemod.com/>. CalEEMod emissions were estimated for the following options from the Project Characteristics menu: Los Angeles-South Coast County; CEC Forecasting Zone 9; Urban Land Use; Construction Start date of January 2<sup>nd</sup> 2017; Operational Year of 2021 (default); and no utility company selected.

Four airport-related projects were identified as occurring during 2017: Airport Perimeter Fence Replacement; Lot 'A' Improvements; Keystone Parking Lot Pavement Repair; and Taxiway 'L' Repairs.

- Airport Perimeter Fence Replacement: This improvement involved replacement of the airport's existing perimeter fencing with a new 8-foot tall anti-climb fence and fabric as well as security camera and system upgrades. The project occurred between January and August 2017 and was modeled using three overlapping CalEEMod phases: Demolition, Trenching, and Site Preparation.
- Lot 'A' Improvements: This improvement involved construction of a new elevator and stair tower, construction of a new vehicle exit, pavement reconstruction of a taxi cab exit lane, and cosmetic upgrades for the parking structure. The project occurred between January and December 2017 and was modeled using four staggered and partially overlapping CalEEMod phases: Building Construction, Demolition, Architectural Coating, and Paving.
- Keystone Parking Lot: This maintenance activity involved a minor pavement repair. The project occurred during September 2017 and was modeled using one CalEEMod phase: Paving.
- Taxiway 'L' Repair: This maintenance activity involved a minor taxiway pavement repair. The project occurred during March 2017 and was modeled using one CalEEMod phase: Paving.

For each project, an approximate square footage was input into CalEEMod to account for demolition hauling and fugitive VOCs from paving where applicable. The equipment and phases modeled in CalEEMod using the default equipment specification are listed in **Table 12**.

**Table 12. Equipment by Phase**

Project - Phase Name	Offroad Equipment Type	Equipment Count
Perimeter Fence-Demo	Concrete/Industrial Saws	1
Perimeter Fence-Demo	Rubber Tired Dozers	1
Perimeter Fence-Electrical	Tractors/Loaders/Backhoes	1
Perimeter Fence-Electrical	Trenchers	1
Perimeter-Fence-Fence Construction	Tractors/Loaders/Backhoes	1
Perimeter-Fence-Fence Construction	Rough Terrain Forklifts	1
Lot A-Demo	Concrete/Industrial Saws	1
Lot A-Demo	Rubber Tired Dozers	1
Lot A-Demo	Tractors/Loaders/Backhoes	1
Lot A-Improvements	Air Compressors	1
Lot A-Construction	Cranes	1
Lot A-Construction	Forklifts	2
LotA-Construction	Welders	1
Lot A-Paving	Cement and Mortar Mixers	2
LotA-Paving	Pavers	1
LotA-Paving	Rollers	1
Keystone Lot-Construction	Tractors/Loaders/Backhoes	1
Keystone Lot-Paving	Cement and Mortar Mixers	1
Keystone Lot-Paving	Pavers	1
Taxiway L-Construction	Tractors/Loaders/Backhoes	1
Taxiway L-Paving	Cement and Mortar Mixers	1
Taxiway L-Paving	Pavers	1

Source: CDM Smith 2019.

## 4.2 Construction Equipment Emissions Inventory

The emissions inventory for LGB 2017 construction activity is presented in **Table 16**.

**Table 16. LGB 2017 Construction Activity Emissions Inventory**

Construction Source Category	Pollutant Emissions, tons per year						Tonnes
	CO	VOC	NOx	SOx	PM10	PM2.5	CO2
Replacement Airline Passenger Terminal Project	-	-	-	-	-	-	-
Miscellaneous Airport Maint.	2.30	0.36	2.91	<0.01	0.31	0.20	336
<b>Total</b>	<b>2.30</b>	<b>0.36</b>	<b>2.91</b>	<b>&lt;0.01</b>	<b>0.31</b>	<b>0.20</b>	<b>336</b>

Source: CDM Smith 2019



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## **Long Beach Airport (LGB)**

Air Quality Improvement Plan  
2023 Business-As-Usual Emissions Inventory  
Final

Prepared for:

City of Long Beach

**Project No. 234216**

August 2019



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# Section 1

## LGB 2023 Air Quality Improvement Plan Business-As-Usual Emissions Inventory

### 1.1 Introduction

The City of Long Beach (City) prepared this business as usual (BAU) emissions inventory for Long Beach Airport (LGB) as a starting point for the Air Quality Improvement Plan (AQIP) that will be negotiated with the South Coast Air Quality Management District (SCAQMD) through a memorandum of understanding (MOU). In addition, the City is preparing baseline and horizon year emission inventories for the airport that will show the estimated Business-As-Usual (BAU) emissions in 2017 and 2031. Each inventory has been prepared using the most accurate information available to the City concerning airport activity and associated emissions of criteria pollutants and greenhouse gases for the AQIP analysis years.

### 1.2 Summary of AQIP BAU Emissions Inventory

A summary of the LGB 2023 AQIP BAU emissions inventory is presented in **Table 1**.<sup>1</sup> The emissions by major source categories are shown graphically on **Figure 1**. The remaining sections of this report provide an overview of the input parameters and assumptions used to develop this inventory.

**Table 1. LGB 2023 AQIP BAU Emissions Inventory**

Airport Emissions Source	Pollutant Emissions, tons per year						CO <sub>2</sub> (MT/yr)
	CO	VOC	NOx	SOx	PM-10	PM-2.5	
<b>Ground Support Equipment Total</b>	<b>118.78</b>	<b>2.04</b>	<b>13.23</b>	<b>0.03</b>	<b>0.47</b>	<b>0.41</b>	<b>2,398</b>
<b>Traffic and Parking</b>							
Regional Traffic	305.16	31.14	23.16	0.84	13.65	5.73	76,750
On-Airport Roadways & Parking Lots	11.73	1.23	1.04	0.03	0.54	0.23	3,035
Paved Road Dust Total	--	--	--	--	26.97	6.74	--
<b>Traffic and Parking Total</b>	<b>316.89</b>	<b>32.37</b>	<b>24.20</b>	<b>0.87</b>	<b>41.16</b>	<b>12.70</b>	<b>79,785</b>
<b>Construction Total</b>	<b>5.47</b>	<b>6.17</b>	<b>8.59</b>	<b>&lt;0.01</b>	<b>1.63</b>	<b>0.99</b>	<b>472</b>
<b>GRAND TOTAL</b>	<b>441.14</b>	<b>40.58</b>	<b>46.02</b>	<b>0.90</b>	<b>43.26</b>	<b>14.10</b>	<b>82,655</b>

Totals may not add exactly due to rounding.

<sup>1</sup> Emissions of criteria pollutants (carbon monoxide, CO; volatile organic compounds, VOC, oxides of nitrogen, NOx, sulfur oxides, SOx, respirable particulate matter, PM-10; and fine particulate matter, PM-2.5) and the major greenhouse gas pollutant carbon dioxide (CO<sub>2</sub>) are presented in this report. Criteria pollutant emissions are presented in short tons per year, while CO<sub>2</sub> emissions are presented in metric tons (tonnes) per year.

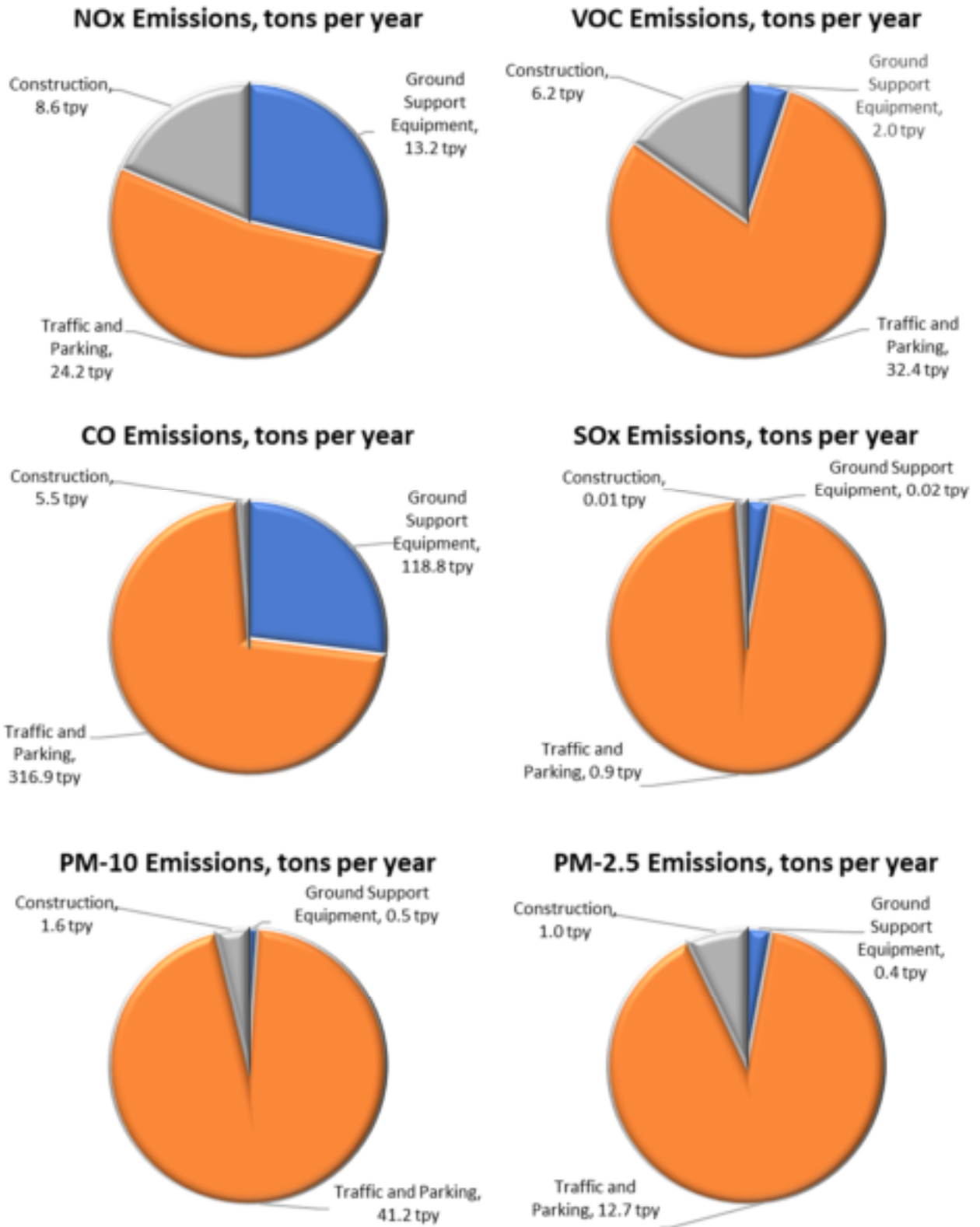


Figure 1. LGB 2023 AQIP BAU Emissions by Major Source Category

## Section 2

# LGB 2023 BAU Ground Support Equipment Emissions Inventory

## 2.1 GSE Inventory, Activity, and Emissions Modeling

Ground support equipment (GSE) at airports includes the vehicles and equipment that service aircraft at the gates, as well as certain equipment used to maintain the airfield. In early 2019, the City in collaboration with Airlines for America (A4A) and other airport stakeholders, conducted a survey of the GSE operating at LGB. The results of that survey allowed the development of airport-wide GSE inventory by equipment type, equipment age, and fuel type, and was assumed to be a representative GSE fleet in 2023. The data collected for this inventory (equipment counts) is summarized in **Table 2**. Approximately 40 percent of the GSE operating at LGB is electric powered.

**Table 2. LGB 2017/2023 GSE Inventory of Equipment by Fuel Type – BAU Scenario**

Equipment Type	Fuel Type			Totals
	Diesel	Gasoline	LPG/Propane	
Air Conditioner	3	0	0	8
Air Start	6	2	0	8
Aircraft Tug	13	4	0	33
Bag Tug	0	9	1	34
Belt Loader	4	4	0	27
Cargo Loader	6	1	0	7
Cargo Tractor	1	7	0	18
Golf Cart	1	4	0	20
Fork Lift	3	0	11	16
GPU	41	1	0	69
Lavatory Cart	0	1	0	4
Lavatory Truck	0	1	0	1
Lift	30	1	0	34
Other GSE	6	9	0	16
Passenger Stairs	0	1	0	1
Fuel Truck	13	5	0	18
Service Truck	0	5	0	5
Sweeper	0	0	0	3
<b>Total</b>	<b>127</b>	<b>55</b>	<b>12</b>	<b>322</b>

Source: CDM Smith, 2019

The California Air Resources Board (ARB) OFFROAD2017<sup>2</sup> model was used to obtain GSE emission factors, deterioration factors, load factors, and activity levels (hours/year/unit). OFFROAD2017 emission factors were obtained by selecting the following options from the model menu: Los Angeles Sub Area of the South Coast Air Basin; 2023 Calendar Year; Adopted Rules – Exhaust Scenario; All Equipment Types; All Model Years; All Horsepower Bins; and All Fuel Types.

Each GSE was matched to OFFROAD2017 equipment types based on the designated Fuel Types and Equipment Types. LPG/Propane GSE was assumed to be equivalent to Natural Gas equipment as listed in the OFFROAD database. When possible, the Equipment Categories AirGrSupp and OFF – AirGrSupp were utilized to pair non-diesel equipment, although Portable Equipment, Light Commercial, or other OFFROAD categories were necessary pairings for Pumps or Generator Sets. The full pairing is listed below in **Table 3**.

**Table 3. LGB GSE Type Pairing with OFFROAD2017 Equipment and Fuel Types**

GSE Cat	OFFROAD Cat (Diesel)	OFFROAD Cat (Gasoline & Nat Gas)
Air Conditioner	Portable Equipment - Non-Rental Generator	OFF - AirGrSupp - Air Conditioner
Air Start	Portable Equipment - Non-Rental Generator	OFF - AirGrSupp - Air Start Unit
Aircraft Tug	AirGrSupp - A/C Tug Narrow Body	OFF - AirGrSupp - A/C Tug Narrow Body
Backhoe	ConstMin - Tractors/Loaders/Backhoes	ConstMin - Tractors/Loaders/Backhoes
Bag Tug	AirGrSupp - Baggage Tug	OFF - AirGrSupp - Baggage Tug
Belt Loader	AirGrSupp - Belt Loader	OFF - AirGrSupp - Belt Loader
Cargo Loader	AirGrSupp - Cargo Loader	OFF - AirGrSupp - Cargo Loader
Cargo Tractor	AirGrSupp - Cargo Tractor	OFF - AirGrSupp - Cargo Tractor
Fork Lift	AirGrSupp - Forklift	OFF - AirGrSupp - Forklift
Fuel Truck	AirGrSupp - Other GSE	OFF - AirGrSupp - Fuel Truck
Generator	Portable Equipment - Non-Rental Generator	OFF - AirGrSupp - Generator
Golf Cart	Portable Equipment - Non-Rental Generator	OFF - AirGrSupp - Cart
GPU	AirGrSupp - Other GSE	OFF - AirGrSupp - Ground Power Unit
Lavatory Cart	AirGrSupp - Other GSE	OFF - AirGrSupp - Lav Cart
Lavatory Truck	AirGrSupp - Other GSE	OFF - AirGrSupp - Lav Truck
Lift	AirGrSupp - Lift	OFF - AirGrSupp - Lift
Other GSE	AirGrSupp - Other GSE	OFF - AirGrSupp - Other GSE
Passenger Stairs	AirGrSupp - Passenger Stand	OFF - AirGrSupp - Passenger Stand
Push Back	AirGrSupp - A/C Tug Narrow Body	OFF - AirGrSupp - A/C Tug Narrow Body
Service Truck	AirGrSupp - Other GSE	OFF - AirGrSupp - Service Truck
Skid Steer Loader	ConstMin - Skid Steer Loaders	ConstMin - Skid Steer Loaders
Sweeper	ConstMin - Sweepers/Scrubbers	OFF - AirGrSupp - Sweeper

Source: CDM Smith, 2019

Based on its category and fuel type, each piece of equipment was matched to the nearest model year and horsepower pairings available in the OFFROAD database. When matching horsepower, the lowest

<sup>2</sup> California Air Resources Board. 2017. OFFROAD2017 Web Database. Available at: <https://www.arb.ca.gov/orion/> (accessed February 13, 2019); and California Air Resources Board. 2017. 2017 Off-Road Diesel Emission Factor Update for NOx and PM. Available at: [https://www.arb.ca.gov/msei/ordiesel/ordas\\_ef\\_fcf\\_2017.pdf](https://www.arb.ca.gov/msei/ordiesel/ordas_ef_fcf_2017.pdf) (accessed February 13, 2019).



horsepower bin that was greater than the identified horsepower was utilized. When no such horsepower bin existed for the specific category / fuel type pairing, the highest horsepower bin that was smaller than the identified horsepower was utilized. If the model year was missing, the average model year of the same type of equipment (bag tug, belt loader, etc.) at LGB was used.

In airport-provided equipment lists, some GSE lacked identifying model years and/or engine horsepower ratings. In this case, equipment was conservatively paired to the oldest model year equipment for the category / fuel type pairing identified in the OFFROAD database. Horsepower ratings were somewhat more subjective, utilizing either a horsepower-hours per year-weighted average horsepower for the equipment type / fuel type pairing or an estimated horsepower rating based high conformity of horsepower ratings for other GSE of the same category used on the airfield.

To estimate the model year for each piece of GSE, the 2023 average fleet age was assumed to be the same as the LGB 2017 GSE fleet age used in the 2017 LGB AQIP Emission Inventory.<sup>3</sup> This was accomplished by increasing the model year for each GSE in the 2017 database by six (6) years (i.e., 2023 minus 2017).

Growth in GSE activity level (hours/year/unit) was developed utilizing the default OFFROAD per-equipment activities for each year. The model includes built-in factors for each equipment type detailing the total hours of operation per year per piece of equipment. Except for air start units, the model showed increasing or flat (no) growth across most equipment categories for each future scenario. This growth is used to account for growth expected at the airfield. GSE activity assumptions are listed in **Table 4**.

**Table 4. OFFROAD GSE Activity per Unit of Equipment per Year**

GSE Cat	2017 Activity (hrs/yr)	2023 Activity (hrs/yr)	Change Relative to 2017
Air Conditioner	1,272	1,357	7%
Air Start	80	74	-8%
Aircraft Tug	320	330	3%
Backhoe	559	602	8%
Bag Tug	714	735	3%
Belt Loader	499	514	3%
Cargo Loader	459	473	3%
Cargo Tractor	651	670	3%
Fork Lift	368	379	3%
Fuel Truck	83	83	0%
Generator	900	896	0%
Golf (Utility) Cart	152	150	-1%
GPU	798	798	0%
Lavatory Cart	151	150	-1%
Lavatory Truck	1,158	1,158	0%
Lift	404	416	3%
Other GSE	464	478	3%
Passenger Stairs	47	48	2%
Push Back	320	330	3%
Service Truck	883	883	0%
Skid Steer Loader	325	350	8%
Sweeper	339	339	0%

Source: CDM Smith 2019.

## 2.2 GSE Emissions Modeling Results

The emission calculation results for LGB 2023 GSE by equipment type are presented in **Table 5**. **Table 6** summarizes the emissions for GSE by fuel type.

**Table 5. GSE Emissions by Equipment Type at LGB in 2023 – BAU Scenario**

GSE Type	Equipment Count	Pollutant Emissions, tons per year						CO2 Tonnes/yr
		CO	VOC	NOx	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	
Air Conditioner	8	0.755	0.038	0.290	0.001	0.018	0.016	101
Air Start	8	0.629	0.021	0.236	0.001	0.007	0.006	49
Aircraft Tug	33	7.762	0.288	2.107	0.003	0.100	0.091	309
Bag Tug	34	32.094	0.278	1.616	0.003	0.021	0.016	304
Belt Loader	27	8.520	0.088	0.577	0.001	0.016	0.014	88
Cargo Loader	7	0.483	0.032	0.356	0.001	0.019	0.017	72
Cargo Tractor	18	16.814	0.158	0.843	0.002	0.013	0.010	171
Golf Cart	20	3.532	0.052	0.052	0.000	0.003	0.002	7
Fork Lift	16	0.913	0.004	0.281	0.000	0.002	0.002	61
GPU	69	7.032	0.233	2.735	0.006	0.057	0.052	541
Lavatory Cart	4	0.821	0.013	0.011	0.000	0.001	0.001	1
Lavatory Truck	1	1.352	0.012	0.120	0.000	0.003	0.002	35
Lift	34	2.242	0.198	1.688	0.002	0.133	0.122	167
Other GSE	16	28.830	0.467	1.200	0.004	0.030	0.024	290
Passenger Stairs	1	0.038	0.000	0.004	0.000	0.000	0.000	1
Fuel Truck	18	0.638	0.115	0.545	0.000	0.031	0.028	29
Service Truck	5	6.324	0.046	0.571	0.002	0.014	0.011	172
Sweeper	3	0.000	0.000	0.000	0.000	0.000	0.000	0
<b>TOTALS</b>	<b>322</b>	<b>118.779</b>	<b>2.043</b>	<b>13.234</b>	<b>0.025</b>	<b>0.466</b>	<b>0.413</b>	<b>2,398</b>

Source: CDM Smith 2019

**Table 6. GSE Emissions by Fuel Type at LGB in 2023 – BAU Scenario**

Fuel Type	Equipment Count	Pollutant Emissions, tons per year						CO2 Tonnes/yr
		CO	VOC	NOx	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	
Diesel	127	7.556	0.708	7.002	0.011	0.367	0.338	1,085
Gasoline	55	108.733	1.334	5.839	0.014	0.099	0.075	1,235
Propane	12	2.489	0.000	0.393	0.000	0.000	0.000	78
Electric	128	--	--	--	--	--	--	--
<b>TOTALS</b>	<b>322</b>	<b>118.779</b>	<b>2.043</b>	<b>13.234</b>	<b>0.025</b>	<b>0.466</b>	<b>0.413</b>	<b>2,398</b>

Source: CDM Smith 2019

## Section 3

# LGB 2023 BAU Traffic and Parking Emissions Inventories

### 3.1 Traffic and Parking Volumes and Miles Traveled

Ground vehicles trips, including passenger cars, taxis, limos, shuttles, buses, and cargo trucks, traveling to or from LGB were estimated for 2023. The basis for total airport trip estimates was the Long Beach Airport Terminal Area Improvements Project EIR. The Ground Transportation Study Phase II, conducted by InterVISTAS Consulting for Long Beach Airport, provided additional ground access travel mode split information.<sup>3</sup> Consistent with other regional airports, an average passenger-trip distance of 20 miles was assumed for passengers traveling to and from the airport by means of private transportation. A distance of 5 miles was assumed for other vehicle trips, such as those associated with commercial courtesy vehicles or other airport-fleet vehicles.

The types of vehicles traveling to and from each trip end-point were segregated into light duty public vehicles (LDA, LDT1, and LDT2); medium duty commercial vehicles (MDV); and light heavy-duty commercial vehicles (LHD1 and LHD2) technology categories in the CARB EMFAC model. The types of vehicular traffic with assigned EMFAC vehicle categories are presented in **Table 7**.

**Table 7. LGB Traffic Breakdown**

Traffic Category	Percent of Traffic	Average Trip Distance	EMFAC Vehicle Category
Private Vehicles	70.88%	20 miles *	LDA/LDT1/LDT2 EMFAC Mix **
Public Transit Vehicles	0.00%	-	-
Other Vehicles ***	1.98%	5 miles ****	LHD2
Taxicabs	9.64%	20 miles *	LDA/LDT1/LDT2 EMFAC Mix **
Limousines	0.11%	20 miles *	LDA/LDT1/LDT2 EMFAC Mix **
TNCs	15.01%	20 miles *	LDA/LDT1/LDT2 EMFAC Mix **
Shared-ride Vans	0.82%	20 miles *	MDV
Hotel/motel courtesy vehicles	1.11%	5 miles ****	MDV
Off-airport parking courtesy vehicles	0.39%	5 miles ****	LHD1
Off-airport rental car courtesy vehicles	0.07%	5 miles ****	LHD1

\* Miles per trip based on comparable passenger trip distances from other South Coast airports.

\*\* VMT-weighted average of EMFAC fleet mix for specified EMFAC vehicle categories

\*\*\* Includes Airport vehicles, police, maintenance, and delivery vehicles.

\*\*\*\* Miles per trip assumed to be 1/4 normal passenger trip distance.

Passenger numbers, projected using data from FAA's Terminal Area Forecast, combined with per-passenger trip generation data, were used to calculate total annual vehicle trips associated with

<sup>3</sup> Long Beach Airport, 2017. Update of Ground Transportation at the Long Beach Airport. Available at: <http://www.longbeach.gov/globalassets/city-manager/media-library/documents/memos-to-the-mayor-tabbed-file-list-folders/2017/august-1--2017---update-of-ground-transportation-at-the-long-beach-airport> (accessed April 1, 2019).

airport activity.<sup>4</sup> These trips were then broken down by transit mode. The total number of trips for vehicles traveling to and from LGB in 2023 is presented in **Table 8**.

**Table 8. Estimated Total Vehicle Trips to LGB in 2023 – BAU Scenario**

Transit Mode		Annual Vehicle Trips to or from LGB
Private Vehicles	Includes passengers driving self as well as pick-up / drop-offs	9,558,584
<b>Subtotal Light Duty Public Vehicles (LDA + LDT1 + LDT2)</b>		<b>9,558,584</b>
Light Commercial	Taxi	1,300,218
Light Commercial	Limousines	14,924
Light Commercial	TNC	2,024,017
<b>Subtotal Light Duty Commercial Vehicles (LDA + LDT1 + LDT2)</b>		<b>3,339,159</b>
Medium Commercial	Shared-ride Vans	110,063
Medium Commercial	Hotel/motel courtesy vehicles	149,236
<b>Subtotal Medium Duty Commercial Vehicles (MDV)</b>		<b>259,299</b>
Light-Heavy Duty Commercial	Off-airport parking courtesy vehicles (LHD1)	52,235
Light-Heavy Duty Commercial	Off-airport rental car courtesy vehicles (LHD1)	9,325
Light-Heavy Duty Commercial	Other Airport vehicles, including maintenance, police, and delivery vehicles (LHD2)	266,761
<b>Subtotal Light-Heavy Duty Commercial Vehicles (LHD1 + LHD2)</b>		<b>328,321</b>

Source: CDM Smith 2019

In lieu of detailed passenger polling data, which was unavailable at the time of this report, an average trip distance traveled for passengers traveling to and from the airport was estimated to be consistent with other local airports. The trip volumes were multiplied by this weighted average trip distance of 20 miles per trip for all transit modes except for commercial courtesy vehicles and other airport vehicles, which were estimated at 5 miles per trip. The resulting annual VMT for each transit mode is presented in **Table 9**.

**Table 9. Regional Miles Traveled for All Trips To or From LGB in 2023 – BAU Scenario**

Transit Mode		Total Annual Vehicle Miles Traveled to or from LGB
Private Vehicles	Includes passengers driving self as well as pick-up / drop-offs	191,171,680
<b>Subtotal Light Duty Public Vehicles (LDA + LDT1 + LDT2)</b>		<b>191,171,680</b>
Light Commercial	Taxi	26,004,360
Light Commercial	Limousines	298,480
Light Commercial	TNC	40,480,340
<b>Subtotal Light Duty Commercial Vehicles (LDA + LDT1 + LDT2)</b>		<b>66,783,180</b>
Medium Commercial	Shared-ride Vans	2,201,260
Medium Commercial	Hotel/motel courtesy vehicles	746,180
<b>Subtotal Medium Duty Commercial Vehicles (MDV)</b>		<b>2,947,440</b>

<sup>4</sup> Federal Aviation Administration. FAA Terminal Area Forecast (TAG), Available at: <https://taf.faa.gov/> (accessed April 8, 2019).

<b>Light-Heavy Duty Commercial</b>	Off-airport parking courtesy vehicles (LHD1)	261,175
<b>Light-Heavy Duty Commercial</b>	Off-airport rental car courtesy vehicles (LHD1)	46,625
<b>Light-Heavy Duty Commercial</b>	Other Airport vehicles, including maintenance, police, and delivery vehicles (LHD2)	1,333,805
<b>Subtotal Light-Heavy Duty Commercial Vehicles (LHD1 + LHD2)</b>		<b>1,641,605</b>

Source: CDM Smith 2019

## 3.2 On-Airport Roadways and Parking Lots

Using the trip volumes in Table 7, distances traveled on airport roadways and in airport parking lots was estimated to be approximately 0.75 miles per one-way trip for all transit modes. This estimated distance was developed from reviewing airport roadways and parking lots in Google Earth Pro. The resulting total distance traveled is summarized in **Table 10**.

**Table 10. On-Airport Miles Traveled for All Trips To or From LGB in 2023 – BAU Scenario**

Transit Mode		Total Annual Vehicle Miles Traveled On-Airport at LGB
<b>Private Vehicles</b>	Includes passengers driving self as well as pick-up / drop-offs	7,168,938
<b>Subtotal Light Duty Public Vehicles (LDA + LDT1 + LDT2)</b>		<b>7,168,938</b>
<b>Light Commercial</b>	Taxi	975,164
<b>Light Commercial</b>	Limousines	11,193
<b>Light Commercial</b>	TNC	1,518,013
<b>Subtotal Light Duty Commercial Vehicles (LDA + LDT1 + LDT2)</b>		<b>2,504,369</b>
<b>Medium Commercial</b>	Shared-ride Vans	82,547
<b>Medium Commercial</b>	Hotel/motel courtesy vehicles	111,927
<b>Subtotal Medium Duty Commercial Vehicles (MDV)</b>		<b>194,474</b>
<b>Light-Heavy Duty Commercial</b>	Off-airport parking courtesy vehicles (LHD1)	39,176
<b>Light-Heavy Duty Commercial</b>	Off-airport rental car courtesy vehicles (LHD1)	6,994
<b>Light-Heavy Duty Commercial</b>	Other Airport vehicles, including maintenance, police, and delivery vehicles (LHD2)	200,071
<b>Subtotal Light-Heavy Duty Commercial Vehicles (LHD1 + LHD2)</b>		<b>246,241</b>

Source: CDM Smith 2019

## 3.3 LGB Traffic and Parking Emissions Inventories

Emission factors from the ARB EMFAC2017 model were used to estimate traffic and parking lot emissions. Emission factors were aggregated by speed and by model years were obtained for all technology categories. The light duty vehicle factors were developed from distance traveled (VMT)-weighted averages of the LDA, LDT1 and LDT2 vehicle types. Medium duty vehicle (MDV) and light-heavy duty vehicle (LHD) factors were developed from EMFAC default values.

The emission factors were developed from EMFAC2017 emission inventories for the South Coast Air Basin portion of Los Angeles County for calendar year 2023. The total pollutant emission inventories (in tons per day) for each of the vehicle technology categories noted above (LDA, LDT1, LDT2, MDV, LHD1, and LHD2) were divided by the EMFAC VMT data for the corresponding vehicle technology

category. The final 2023 emission factors, in grams per mile, for each pollutant are summarized in **Table 11**. In addition, re-entrained road dust was estimated the method described in Chapter 13.2.1 Paved Roads in U.S. EPA’s Compilation of Air Pollutant Emission Factors (AP-42).

**Table 11. 2023 Emission Factors from EMFAC2017**

Vehicle Category	2023 Calendar Year Emission Factors, grams/mile						
	CO	VOC	NOx	SOx	PM10	PM2.5	CO2e
LDAT <sup>a</sup>	1.052	0.106	0.075	0.003	0.047	0.020	289
MDV <sup>b</sup>	1.477	0.167	0.138	0.004	0.047	0.020	414
LHD1 <sup>c</sup>	1.028	0.294	0.684	0.006	0.0093	0.041	661
LHD2 <sup>d</sup>	0.692	0.200	0.813	0.006	0.110	0.051	662
Paved Road Dust	--	--	--	--	0.090	0.022	--

Source: CDM Smith 2019.

- a. LDAT = Light Duty Autos and Trucks. Emission factors developed from LDA, LDT1, and LDT2 total emissions (South Coast portion of Los Angeles County in 2023).
- b. MDV = Medium Duty vehicles. Emission factors developed from MDV total emissions (South Coast portion of Los Angeles County in 2023).
- c. LHD1 = Light-Heavy Duty vehicles. Emission factors developed from LHD1 total emissions (South Coast portion of Los Angeles County in 2023).
- d. LHD2 = Light-Heavy Duty vehicles. Emission factors developed from LHD2 total emissions (South Coast portion of Los Angeles County in 2023).

The LGB 2023 total traffic emission inventories are summarized in **Table 12**.

**Table 12. Grand Total - LGB BAU Traffic Emissions**

Airport Destination	Pollutant Emissions, tpy						CO2e MT/yr
	CO	VOC	NOx	SO2	PM10	PM2.5	
<b>Regional Emissions</b>	305.164	31.140	23.164	0.837	13.645	5.729	76,750
<b>On-Airport Traffic &amp; Parking Emissions</b>	11.734	1.228	1.042	0.033	0.538	0.227	3,035
<b>Paved Road Dust</b>	--	--	--	--	26.967	6.742	--
<b>TOTAL Traffic-Related Emissions</b>	<b>316.898</b>	<b>32.368</b>	<b>24.206</b>	<b>0.870</b>	<b>41.150</b>	<b>12.697</b>	<b>79,785</b>

Source: CDM Smith 2019.

## Section 4

# LGB 2023 BAU Construction Source Emissions Inventory

### 4.1 Construction Emission Documents

In 2023, routine maintenance and minor improvements are expected to occur on and around the Long Beach Airport (LGB). No major construction activity, such as the upcoming Phase II of the LGB Terminal Area Improvements, is anticipated to occur during 2023. However, for the purposes of accounting for emissions from potential construction activity at LGB in 2023, peak emissions from the airport's 2017 construction activity and the Terminal Area Improvements Phase II construction were included in this 2023 BAU construction scenario. For the 2023 BAU emissions inventory, routine construction associated with maintenance and minor improvements was assumed to be comparable in magnitude to the routine construction activities of the 2017 baseline. Descriptions of routine maintenance and minor airport improvements were provided by the airport and emission estimates were made to account for this activity.

Emissions were calculated using the California Emission Estimator Model (CalEEMod) version 2016.3.2. The model can be accessed at <http://www.caleemod.com/>. CalEEMod emissions were estimated for the following options from the Project Characteristics menu: Los Angeles-South Coast County; CEC Forecasting Zone 9; Urban Land Use; Construction Start date of January 2, 2017; Operational Year of 2021 (default); and no utility company selected.

Four airport-related projects were identified as occurring during 2017: Airport Perimeter Fence Replacement; Lot 'A' Improvements; Keystone Parking Lot Pavement Repair; and Taxiway 'L' Repairs.

- Airport Perimeter Fence Replacement: This improvement involved replacement of the airport's existing perimeter fencing with a new 8-foot tall anti-climb fence and fabric as well as security camera and system upgrades. The project occurred between January and August 2017 and was modeled using three overlapping CalEEMod phases: Demolition, Trenching, and Site Preparation.
- Lot 'A' Improvements: This improvement involved construction of a new elevator and stair tower, construction of a new vehicle exit, pavement reconstruction of a taxi cab exit lane, and cosmetic upgrades for the parking structure. The project occurred between January and December 2017 and was modeled using four staggered and partially overlapping CalEEMod phases: Building Construction, Demolition, Architectural Coating, and Paving.
- Keystone Parking Lot: This maintenance activity involved a minor pavement repair. The project occurred during September 2017 and was modeled using one CalEEMod phase: Paving.
- Taxiway 'L' Repair: This maintenance activity involved a minor taxiway pavement repair. The project occurred during March 2017 and was modeled using one CalEEMod phase: Paving.

For each project, an approximate square footage was input into CalEEMod to account for demolition hauling and fugitive VOCs from paving where applicable. The equipment and phases modeled in CalEEMod using the default equipment specification are listed in **Table 13**.

**Table 13. Equipment by Phase**

Project - Phase Name	Offroad Equipment Type	Equipment Count
Perimeter Fence-Demo	Concrete/Industrial Saws	1
Perimeter Fence-Demo	Rubber Tired Dozers	1
Perimeter Fence-Electrical	Tractors/Loaders/Backhoes	1
Perimeter Fence-Electrical	Trenchers	1
Perimeter-Fence-Fence Construction	Tractors/Loaders/Backhoes	1
Perimeter-Fence-Fence Construction	Rough Terrain Forklifts	1
Lot A-Demo	Concrete/Industrial Saws	1
Lot A-Demo	Rubber Tired Dozers	1
Lot A-Demo	Tractors/Loaders/Backhoes	1
Lot A-Improvements	Air Compressors	1
Lot A-Construction	Cranes	1
Lot A-Construction	Forklifts	2
LotA-Construction	Welders	1
Lot A-Paving	Cement and Mortar Mixers	2
LotA-Paving	Pavers	1
LotA-Paving	Rollers	1
Keystone Lot-Construction	Tractors/Loaders/Backhoes	1
Keystone Lot-Paving	Cement and Mortar Mixers	1
Keystone Lot-Paving	Pavers	1
Taxiway L-Construction	Tractors/Loaders/Backhoes	1
Taxiway L-Paving	Cement and Mortar Mixers	1
Taxiway L-Paving	Pavers	1

Source: CDM Smith 2019.

## 4.2 Construction Equipment Emissions Inventory

The emissions inventory for LGB 2023 BAU construction activity is presented in **Table 14**.

**Table 14. LGB 2023 BAU Construction Activity Emissions Inventory**

Construction Source Category	Pollutant Emissions, tons per year						Tonnes
	CO	VOC	NOx	SOx	PM10	PM2.5	
Terminal Area Improvements Project – Phase II*	3.14	5.76	5.63	<0.01	1.31	0.79	136
Miscellaneous Airport Maint.	2.30	0.36	2.91	<0.01	0.31	0.20	336
<b>Total</b>	<b>5.44</b>	<b>6.12</b>	<b>8.54</b>	<b>&lt;0.01</b>	<b>1.62</b>	<b>0.99</b>	<b>472</b>

Source: CDM Smith 2019

\* Terminal Area Improvements Project - Phase II annual construction emissions estimated from peak daily construction emissions presented in the Addendum to Final Environmental Impact Report 37-03<sup>5</sup> and the ratio of peak daily construction emissions to annual construction emissions for Terminal Construction and Support activities presented in the Terminal Area Improvements Project Final Environmental Impact Report 37-03.<sup>6</sup>

<sup>5</sup> City of Long Beach. 2018. Phase II Long Beach Airport Terminal Area Improvements Project, Addendum to Final Environmental Impact Report 37-03 (State Clearinghouse No. 200309112). March.

<sup>6</sup> City of Long Beach. 2006. Long Beach Airport – Terminal Area Improvements Project. Final Environmental Impact Report 37-03.



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## **Long Beach Airport (LGB)**

Air Quality Improvement Plan  
2031 Business-As-Usual Emissions Inventory  
Final

Prepared for:

City of Long Beach

**Project No. 234216**

August 2019



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# Section 1

## LGB 2031 Air Quality Improvement Plan Business-As-Usual Emissions Inventory

### 1.1 Introduction

The City of Long Beach (City) prepared this business as usual (BAU) emissions inventory for Long Beach Airport (LGB) as a starting point for the Air Quality Improvement Plan (AQIP) that will be negotiated with the South Coast Air Quality Management District (SCAQMD) through a memorandum of understanding (MOU). In addition, the City is preparing baseline and future year emission inventories for the airport that will show the estimated Business-As-Usual (BAU) emissions in 2017 and 2023. Each inventory has been prepared using the most accurate information available to the City concerning airport activity and associated emissions of criteria pollutants and greenhouse gases for the AQIP analysis years.

### 1.2 Summary of AQIP BAU Emissions Inventory

A summary of the LGB 2031 AQIP BAU emissions inventory is presented in **Table 1**.<sup>1</sup> The emissions by major source categories are shown graphically on **Figure 1**. The remaining sections of this report provide an overview of the input parameters and assumptions used to develop this inventory.

**Table 1. LGB 2031 AQIP BAU Emissions Inventory**

Airport Emissions Source	Pollutant Emissions, tons per year						CO <sub>2</sub> (MT/yr)
	CO	VOC	NO <sub>x</sub>	SO <sub>x</sub>	PM-10	PM-2.5	
<b>Ground Support Equipment Total</b>	<b>132.66</b>	<b>1.74</b>	<b>10.54</b>	<b>0.03</b>	<b>0.22</b>	<b>0.19</b>	<b>2,559</b>
<b>Traffic and Parking</b>							
Regional Traffic	241.40	23.21	14.37	0.76	14.95	6.16	69,261
On-Airport Roadways & Parking Lots	9.26	0.91	0.62	0.03	0.59	0.24	2,745
Paved Road Dust Total	--	--	--	--	29.99	7.50	--
<b>Traffic and Parking Total</b>	<b>250.66</b>	<b>24.12</b>	<b>14.99</b>	<b>0.79</b>	<b>45.53</b>	<b>13.90</b>	<b>72,006</b>
<b>Construction Total</b>	<b>2.30</b>	<b>0.36</b>	<b>2.91</b>	<b>&lt;0.01</b>	<b>0.31</b>	<b>0.20</b>	<b>336</b>
<b>GRAND TOTAL</b>	<b>385.62</b>	<b>26.22</b>	<b>28.44</b>	<b>0.82</b>	<b>46.06</b>	<b>14.29</b>	<b>74,901</b>

Totals may not add exactly due to rounding.

<sup>1</sup> Emissions of criteria pollutants (carbon monoxide, CO; volatile organic compounds, VOC, oxides of nitrogen, NO<sub>x</sub>, sulfur oxides, SO<sub>x</sub>, respirable particulate matter, PM-10; and fine particulate matter, PM-2.5) and the major greenhouse gas pollutant carbon dioxide (CO<sub>2</sub>) are presented in this report. Criteria pollutant emissions are presented in short tons per year, while CO<sub>2</sub> emissions are presented in metric tons (tonnes) per year.

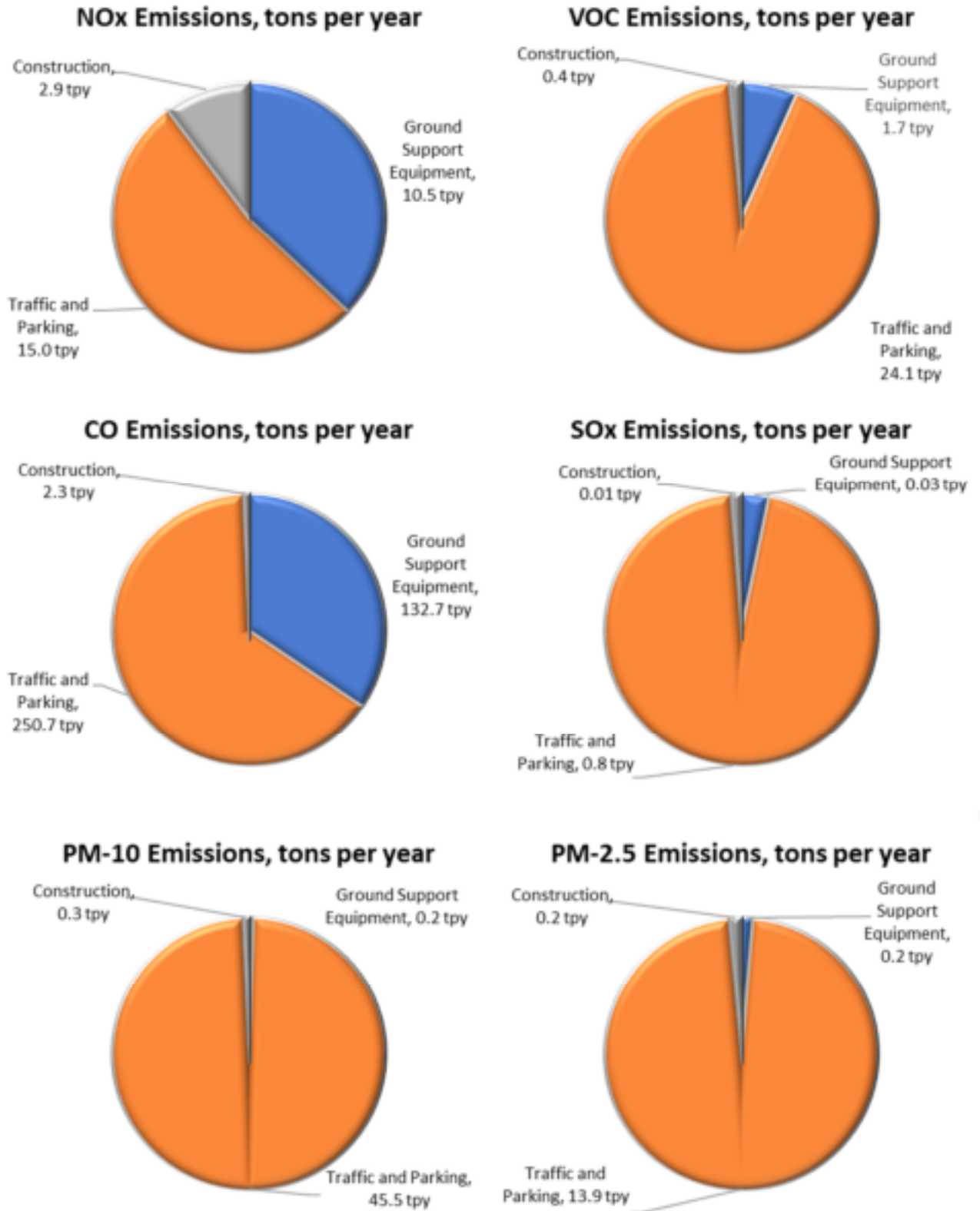


Figure 1. LGB 2031 AQIP BAU Emissions by Major Source Category

## Section 2

# LGB 2031 BAU Ground Support Equipment Emissions Inventory

## 2.1 GSE Inventory, Activity, and Emissions Modeling

Ground support equipment (GSE) at airports includes the vehicles and equipment that service aircraft at the gates, as well as certain equipment used to maintain the airfield. In early 2019, the City in collaboration with Airlines for America (A4A) and other airport stakeholders, conducted a survey of the GSE operating at LGB. The results of that survey allowed the development of airport-wide GSE inventory by equipment type, equipment age, and fuel type, and was assumed to be a representative GSE fleet in 2031. The data collected for this inventory (equipment counts) is summarized in **Table 2**. Approximately 40 percent of the GSE operating at LGB is electric powered.

**Table 2. LGB 2017/2031 GSE Inventory of Equipment by Fuel Type – BAU Scenario**

Equipment Type	Fuel Type			Totals
	Diesel	Gasoline	LPG/Propane	
Air Conditioner	3	0	0	8
Air Start	6	2	0	8
Aircraft Tug	13	4	0	33
Bag Tug	0	9	1	34
Belt Loader	4	4	0	27
Cargo Loader	6	1	0	7
Cargo Tractor	1	7	0	18
Golf Cart	1	4	0	20
Fork Lift	3	0	11	16
GPU	41	1	0	69
Lavatory Cart	0	1	0	4
Lavatory Truck	0	1	0	1
Lift	30	1	0	34
Other GSE	6	9	0	16
Passenger Stairs	0	1	0	1
Fuel Truck	13	5	0	18
Service Truck	0	5	0	5
Sweeper	0	0	0	3
<b>Total</b>	<b>127</b>	<b>55</b>	<b>12</b>	<b>322</b>

Source: CDM Smith, 2019

The California Air Resources Board (ARB) OFFROAD2017<sup>2</sup> model was used to obtain GSE emission factors, deterioration factors, load factors, and activity levels (hours/year/unit). OFFROAD2017 emission factors were obtained by selecting the following options from the model menu: Los Angeles Sub Area of the South Coast Air Basin; 2031 Calendar Year; Adopted Rules – Exhaust Scenario; All Equipment Types; All Model Years; All Horsepower Bins; and All Fuel Types.

Each GSE was matched to OFFROAD2017 equipment types based on the designated Fuel Types and Equipment Types. LPG/Propane GSE was assumed to be equivalent to Natural Gas equipment as listed in the OFFROAD database. When possible, the Equipment Categories AirGrSupp and OFF – AirGrSupp were utilized to pair non-diesel equipment, although Portable Equipment, Light Commercial, or other OFFROAD categories were necessary pairings for Pumps or Generator Sets. The full pairing is listed below in **Table 3**.

**Table 3. LGB GSE Type Pairing with OFFROAD2017 Equipment and Fuel Types**

GSE Cat	OFFROAD Cat (Diesel)	OFFROAD Cat (Gasoline & Nat Gas)
Air Conditioner	Portable Equipment - Non-Rental Generator	OFF - AirGrSupp - Air Conditioner
Air Start	Portable Equipment - Non-Rental Generator	OFF - AirGrSupp - Air Start Unit
Aircraft Tug	AirGrSupp - A/C Tug Narrow Body	OFF - AirGrSupp - A/C Tug Narrow Body
Backhoe	ConstMin - Tractors/Loaders/Backhoes	ConstMin - Tractors/Loaders/Backhoes
Bag Tug	AirGrSupp - Baggage Tug	OFF - AirGrSupp - Baggage Tug
Belt Loader	AirGrSupp - Belt Loader	OFF - AirGrSupp - Belt Loader
Cargo Loader	AirGrSupp - Cargo Loader	OFF - AirGrSupp - Cargo Loader
Cargo Tractor	AirGrSupp - Cargo Tractor	OFF - AirGrSupp - Cargo Tractor
Fork Lift	AirGrSupp - Forklift	OFF - AirGrSupp - Forklift
Fuel Truck	AirGrSupp - Other GSE	OFF - AirGrSupp - Fuel Truck
Generator	Portable Equipment - Non-Rental Generator	OFF - AirGrSupp - Generator
Golf Cart	Portable Equipment - Non-Rental Generator	OFF - AirGrSupp - Cart
GPU	AirGrSupp - Other GSE	OFF - AirGrSupp - Ground Power Unit
Lavatory Cart	AirGrSupp - Other GSE	OFF - AirGrSupp - Lav Cart
Lavatory Truck	AirGrSupp - Other GSE	OFF - AirGrSupp - Lav Truck
Lift	AirGrSupp - Lift	OFF - AirGrSupp - Lift
Other GSE	AirGrSupp - Other GSE	OFF - AirGrSupp - Other GSE
Passenger Stairs	AirGrSupp - Passenger Stand	OFF - AirGrSupp - Passenger Stand
Push Back	AirGrSupp - A/C Tug Narrow Body	OFF - AirGrSupp - A/C Tug Narrow Body
Service Truck	AirGrSupp - Other GSE	OFF - AirGrSupp - Service Truck
Skid Steer Loader	ConstMin - Skid Steer Loaders	ConstMin - Skid Steer Loaders
Sweeper	ConstMin - Sweepers/Scrubbers	OFF - AirGrSupp - Sweeper

Source: CDM Smith, 2019

Based on its category and fuel type, each piece of equipment was matched to the nearest model year and horsepower pairings available in the OFFROAD database. When matching horsepower, the lowest

<sup>2</sup> California Air Resources Board. 2017. OFFROAD2017 Web Database. Available at: <https://www.arb.ca.gov/orion/> (accessed February 13, 2019); and California Air Resources Board. 2017. 2017 Off-Road Diesel Emission Factor Update for NOx and PM. Available at: [https://www.arb.ca.gov/msei/ordiesel/ordas\\_ef\\_fcf\\_2017.pdf](https://www.arb.ca.gov/msei/ordiesel/ordas_ef_fcf_2017.pdf) (accessed February 13, 2019).



horsepower bin that was greater than the identified horsepower was utilized. When no such horsepower bin existed for the specific category / fuel type pairing, the highest horsepower bin that was smaller than the identified horsepower was utilized. If the model year was missing, the average model year of the same type of equipment (bag tug, belt loader, etc.) at LGB was used.

In airport-provided equipment lists, some GSE lacked identifying model years and/or engine horsepower ratings. In this case, equipment was conservatively paired to the oldest model year equipment for the category / fuel type pairing identified in the OFFROAD database. Horsepower ratings were somewhat more subjective, utilizing either a horsepower-hours per year-weighted average horsepower for the equipment type / fuel type pairing or an estimated horsepower rating based high conformity of horsepower ratings for other GSE of the same category used on the airfield.

To estimate the model year for each piece of GSE, the 2031 average fleet age was assumed to be the same as the LGB 2017 GSE fleet age used in the 2017 LGB AQIP Emission Inventory.<sup>3</sup> This was accomplished by increasing the model year for each GSE in the 2017 database by 14 years (i.e., 2031 minus 2017).

Growth in GSE activity level (hours/year/unit) was developed utilizing the default OFFROAD per-equipment activities for each year. The model includes built-in factors for each equipment type detailing the total hours of operation per year per piece of equipment. Except for air start units, the model showed increasing or flat (no) growth across most equipment categories for each future scenario. This growth is used to account for growth expected at the airfield. GSE activity assumptions are listed in **Table 4**.

**Table 4. OFFROAD GSE Activity per Unit of Equipment per Year**

GSE Cat	2017 Activity (hrs/yr)	2031 Activity (hrs/yr)	Change Relative to 2017
Air Conditioner	1,272	1,480	16%
Air Start	80	66	-18%
Aircraft Tug	320	342	7%
Backhoe	559	627	12%
Bag Tug	714	762	7%
Belt Loader	499	533	7%
Cargo Loader	459	490	7%
Cargo Tractor	651	695	7%
Fork Lift	368	393	7%
Fuel Truck	83	83	0%
Generator	900	898	0%
Golf (Utility) Cart	152	150	-1%
GPU	798	798	0%
Lavatory Cart	151	150	-1%
Lavatory Truck	1,158	1,158	0%
Lift	404	431	7%
Other GSE	464	496	7%
Passenger Stairs	47	50	6%
Push Back	320	342	7%
Service Truck	883	883	0%
Skid Steer Loader	325	365	12%
Sweeper	339	339	0%

Source: CDM Smith 2019.

## 2.2 GSE Emissions Modeling Results

The emission calculation results for LGB 2031 GSE by equipment type are presented in **Table 5**. **Table 6** summarizes the emissions for GSE by fuel type.

**Table 5. GSE Emissions by Equipment Type at LGB in 2031 – BAU Scenario**

GSE Type	Equipment Count	Pollutant Emissions, tons per year						CO2 Tonnes/yr
		CO	VOC	NOx	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	
Air Conditioner	8	0.572	0.036	0.325	0.001	0.009	0.008	70
Air Start	8	0.752	0.018	0.149	0.001	0.005	0.004	56
Aircraft Tug	33	8.540	0.185	1.212	0.003	0.031	0.027	318
Bag Tug	34	35.444	0.307	1.785	0.003	0.023	0.018	336
Belt Loader	27	9.343	0.093	0.529	0.001	0.007	0.005	97
Cargo Loader	7	0.539	0.025	0.240	0.001	0.009	0.008	79
Cargo Tractor	18	18.601	0.175	0.933	0.002	0.014	0.011	189
Golf Cart	20	4.083	0.060	0.060	0.000	0.003	0.002	8
Fork Lift	16	0.982	0.003	0.281	0.000	0.000	0.000	63
GPU	69	7.559	0.209	1.883	0.006	0.019	0.016	592
Lavatory Cart	4	0.982	0.016	0.014	0.000	0.001	0.001	2
Lavatory Truck	1	1.478	0.013	0.131	0.000	0.003	0.002	39
Lift	34	2.247	0.075	0.864	0.002	0.020	0.018	165
Other GSE	16	33.787	0.377	1.026	0.004	0.022	0.017	321
Passenger Stairs	1	0.042	0.000	0.004	0.000	0.000	0.000	1
Fuel Truck	18	0.793	0.097	0.480	0.000	0.043	0.039	36
Service Truck	5	6.914	0.050	0.625	0.002	0.015	0.012	188
Sweeper	3	0.000	0.000	0.000	0.000	0.000	0.000	0
<b>TOTALS</b>	<b>322</b>	<b>132.659</b>	<b>1.740</b>	<b>10.540</b>	<b>0.027</b>	<b>0.223</b>	<b>0.187</b>	<b>2,559</b>

Source: CDM Smith 2019

**Table 6. GSE Emissions by Fuel Type at LGB in 2031 – BAU Scenario**

Fuel Type	Equipment Count	Pollutant Emissions, tons per year						CO2 Tonnes/yr
		CO	VOC	NOx	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	
Diesel	127	7.597	0.485	4.291	0.011	0.114	0.105	1,110
Gasoline	55	122.308	1.254	5.815	0.015	0.109	0.083	1,363
Propane	12	2.754	0.000	0.434	0.000	0.000	0.000	86
Electric	128	--	--	--	--	--	--	--
<b>TOTALS</b>	<b>322</b>	<b>132.659</b>	<b>1.740</b>	<b>10.540</b>	<b>0.027</b>	<b>0.223</b>	<b>0.187</b>	<b>2,559</b>

Source: CDM Smith 2019

## Section 3

# LGB 2031 BAU Traffic and Parking Emissions Inventories

### 3.1 Traffic and Parking Volumes and Miles Traveled

Ground vehicles trips, including passenger cars, taxis, limos, shuttles, buses, and cargo trucks, traveling to or from LGB were estimated for 2031. The basis for total airport trip estimates was the Long Beach Airport Terminal Area Improvements Project EIR. The Ground Transportation Study Phase II, conducted by InterVISTAS Consulting for Long Beach Airport, provided additional ground access travel mode split information.<sup>3</sup> Consistent with other regional airports, an average passenger-trip distance of 20 miles was assumed for passengers traveling to and from the airport by means of private transportation. A distance of 5 miles was assumed for other vehicle trips, such as those associated with commercial courtesy vehicles or other airport-fleet vehicles.

The types of vehicles traveling to and from each trip end-point were segregated into light duty public vehicles (LDA, LDT1, and LDT2); medium duty commercial vehicles (MDV); and light heavy-duty commercial vehicles (LHD1 and LHD2) technology categories in the CARB EMFAC model. The types of vehicular traffic with assigned EMFAC vehicle categories are presented in **Table 7**.

**Table 7. LGB Traffic Breakdown**

Traffic Category	Percent of Traffic	Average Trip Distance	EMFAC Vehicle Category
Private Vehicles	70.88%	20 miles *	LDA/LDT1/LDT2 EMFAC Mix **
Public Transit Vehicles	0.00%	-	-
Other Vehicles ***	1.98%	5 miles ****	LHD2
Taxicabs	9.64%	20 miles *	LDA/LDT1/LDT2 EMFAC Mix **
Limousines	0.11%	20 miles *	LDA/LDT1/LDT2 EMFAC Mix **
TNCs	15.01%	20 miles *	LDA/LDT1/LDT2 EMFAC Mix **
Shared-ride Vans	0.82%	20 miles *	MDV
Hotel/motel courtesy vehicles	1.11%	5 miles ****	MDV
Off-airport parking courtesy vehicles	0.39%	5 miles ****	LHD1
Off-airport rental car courtesy vehicles	0.07%	5 miles ****	LHD1

\* Miles per trip based on comparable passenger trip distances from other South Coast airports.

\*\* VMT-weighted average of EMFAC fleet mix for specified EMFAC vehicle categories

\*\*\* Includes Airport vehicles, police, maintenance, and delivery vehicles.

\*\*\*\* Miles per trip assumed to be 1/4 normal passenger trip distance.

Passenger numbers, projected using data from FAA's Terminal Area Forecast, combined with per-passenger trip generation data, were used to calculate total annual vehicle trips associated with

<sup>3</sup> Long Beach Airport, 2017. Update of Ground Transportation at the Long Beach Airport. Available at: <http://www.longbeach.gov/globalassets/city-manager/media-library/documents/memos-to-the-mayor-tabbed-file-list-folders/2017/august-1--2017---update-of-ground-transportation-at-the-long-beach-airport> (accessed April 1, 2019).

airport activity.<sup>4</sup> These trips were then broken down by transit mode. The total number of trips for vehicles traveling to and from LGB in 2031 is presented in **Table 8**.

**Table 8. Estimated Total Vehicle Trips to LGB in 2031 – BAU Scenario**

Transit Mode		Annual Vehicle Trips to or from LGB
Private Vehicles	Includes passengers driving self as well as pick-up / drop-offs	10,629,501
<b>Subtotal Light Duty Public Vehicles (LDA + LDT1 + LDT2)</b>		<b>10,629,501</b>
Light Commercial	Taxi	1,445,891
Light Commercial	Limousines	16,596
Light Commercial	TNC	2,250,782
<b>Subtotal Light Duty Commercial Vehicles (LDA + LDT1 + LDT2)</b>		<b>3,713,269</b>
Medium Commercial	Shared-ride Vans	122,394
Medium Commercial	Hotel/motel courtesy vehicles	165,956
<b>Subtotal Medium Duty Commercial Vehicles (MDV)</b>		<b>288,350</b>
Light-Heavy Duty Commercial	Off-airport parking courtesy vehicles (LHD1)	58,087
Light-Heavy Duty Commercial	Off-airport rental car courtesy vehicles (LHD1)	10,369
Light-Heavy Duty Commercial	Other Airport vehicles, including maintenance, police, and delivery vehicles (LHD2)	296,648
<b>Subtotal Light-Heavy Duty Commercial Vehicles (LHD1 + LHD2)</b>		<b>365,104</b>

Source: CDM Smith 2019

In lieu of detailed passenger polling data, which was unavailable at the time of this report, an average trip distance traveled for passengers traveling to and from the airport was estimated to be consistent with other local airports. The trip volumes were multiplied by this weighted average trip distance of 20 miles per trip for all transit modes except for commercial courtesy vehicles and other airport vehicles, which were estimated at 5 miles per trip. The resulting annual VMT for each transit mode is presented in **Table 9**.

**Table 9. Regional Miles Traveled for All Trips To or From LGB in 2031 – BAU Scenario**

Transit Mode		Total Annual Vehicle Miles Traveled to or from LGB
Private Vehicles	Includes passengers driving self as well as pick-up / drop-offs	212,590,020
<b>Subtotal Light Duty Public Vehicles (LDA + LDT1 + LDT2)</b>		<b>212,590,020</b>
Light Commercial	Taxi	28,917,820
Light Commercial	Limousines	331,920
Light Commercial	TNC	45,015,640
<b>Subtotal Light Duty Commercial Vehicles (LDA + LDT1 + LDT2)</b>		<b>74,265,380</b>
Medium Commercial	Shared-ride Vans	2,447,880
Medium Commercial	Hotel/motel courtesy vehicles	829,780
<b>Subtotal Medium Duty Commercial Vehicles (MDV)</b>		<b>3,277,660</b>

<sup>4</sup> Federal Aviation Administration. FAA Terminal Area Forecast (TAG), Available at: <https://taf.faa.gov/> (accessed April 8, 2019).

<b>Light-Heavy Duty Commercial</b>	Off-airport parking courtesy vehicles (LHD1)	290,435
<b>Light-Heavy Duty Commercial</b>	Off-airport rental car courtesy vehicles (LHD1)	51,845
<b>Light-Heavy Duty Commercial</b>	Other Airport vehicles, including maintenance, police, and delivery vehicles (LHD2)	1,483,240
<b>Subtotal Light-Heavy Duty Commercial Vehicles (LHD1 + LHD2)</b>		<b>1,825,520</b>

Source: CDM Smith 2019

## 3.2 On-Airport Roadways and Parking Lots

Using the trip volumes in Table 7, distances traveled on airport roadways and in airport parking lots was estimated to be approximately 0.75 miles per one-way trip for all transit modes. This estimated distance was developed from reviewing airport roadways and parking lots in Google Earth Pro. The resulting total distance traveled is summarized in **Table 10**.

**Table 10. On-Airport Miles Traveled for All Trips To or From LGB in 2031 – BAU Scenario**

Transit Mode		Total Annual Vehicle Miles Traveled On-Airport at LGB
<b>Private Vehicles</b>	Includes passengers driving self as well as pick-up / drop-offs	7,972,126
<b>Subtotal Light Duty Public Vehicles (LDA + LDT1 + LDT2)</b>		<b>7,972,126</b>
<b>Light Commercial</b>	Taxi	1,084,418
<b>Light Commercial</b>	Limousines	12,447
<b>Light Commercial</b>	TNC	1,688,087
<b>Subtotal Light Duty Commercial Vehicles (LDA + LDT1 + LDT2)</b>		<b>2,784,952</b>
<b>Medium Commercial</b>	Shared-ride Vans	91,796
<b>Medium Commercial</b>	Hotel/motel courtesy vehicles	124,467
<b>Subtotal Medium Duty Commercial Vehicles (MDV)</b>		<b>216,263</b>
<b>Light-Heavy Duty Commercial</b>	Off-airport parking courtesy vehicles (LHD1)	43,565
<b>Light-Heavy Duty Commercial</b>	Off-airport rental car courtesy vehicles (LHD1)	7,777
<b>Light-Heavy Duty Commercial</b>	Other Airport vehicles, including maintenance, police, and delivery vehicles (LHD2)	222,486
<b>Subtotal Light-Heavy Duty Commercial Vehicles (LHD1 + LHD2)</b>		<b>273,828</b>

Source: CDM Smith 2019

## 3.3 LGB Traffic and Parking Emissions Inventories

Emission factors from the ARB EMFAC2017 model were used to estimate traffic and parking lot emissions. Emission factors were aggregated by speed and by model years were obtained for all technology categories. The light duty vehicle factors were developed from distance traveled (VMT)-weighted averages of the LDA, LDT1 and LDT2 vehicle types. Medium duty vehicle (MDV) and light-heavy duty vehicle (LHD) factors were developed from EMFAC default values.

The emission factors were developed from EMFAC2017 emission inventories for the South Coast Air Basin portion of Los Angeles County for calendar year 2031. The total pollutant emission inventories (in tons per day) for each of the vehicle technology categories noted above (LDA, LDT1, LDT2, MDV, LHD1, and LHD2) were divided by the EMFAC VMT data for the corresponding vehicle technology

category. The final 2031 emission factors, in grams per mile, for each pollutant are summarized in **Table 11**. In addition, re-entrained road dust was estimated the method described in Chapter 13.2.1 Paved Roads in U.S. EPA's Compilation of Air Pollutant Emission Factors (AP-42).

**Table 11. 2031 Emission Factors from EMFAC2017**

Vehicle Category	2031 Calendar Year Emission Factors, grams/mile						
	CO	VOC	NOx	SOx	PM10	PM2.5	CO2e
LDAT <sup>a</sup>	0.750	0.071	0.043	0.002	0.046	0.019	234
MDV <sup>b</sup>	0.933	0.109	0.061	0.003	0.046	0.019	326
LHD1 <sup>c</sup>	0.612	0.201	0.285	0.006	0.091	0.040	568
LHD2 <sup>d</sup>	0.461	0.117	0.337	0.006	0.110	0.050	572
Paved Road Dust	--	--	--	--	0.090	0.022	--

Source: CDM Smith 2019.

- LDAT = Light Duty Autos and Trucks. Emission factors developed from LDA, LDT1, and LDT2 total emissions (South Coast portion of Los Angeles County in 2031).
- MDV = Medium Duty vehicles. Emission factors developed from MDV total emissions (South Coast portion of Los Angeles County in 2031).
- LHD1 = Light-Heavy Duty vehicles. Emission factors developed from LHD1 total emissions (South Coast portion of Los Angeles County in 2031).
- LHD2 = Light-Heavy Duty vehicles. Emission factors developed from LHD2 total emissions (South Coast portion of Los Angeles County in 2031).

The LGB 2031 total traffic emission inventories are summarized in **Table 12**.

**Table 12. Grand Total - LGB BAU Traffic Emissions**

Airport Destination	Pollutant Emissions, tpy						CO2e MT/yr
	CO	VOC	NOx	SO2	PM10	PM2.5	
<b>Regional Emissions</b>	241.400	23.211	14.374	0.755	14.945	6.160	69,261
<b>On-Airport Traffic &amp; Parking Emissions</b>	9.259	0.912	0.619	0.030	0.589	0.244	2,745
<b>Paved Road Dust</b>	--	--	--	--	29.989	7.497	--
<b>TOTAL Traffic-Related Emissions</b>	<b>250.659</b>	<b>24.122</b>	<b>14.993</b>	<b>0.785</b>	<b>45.523</b>	<b>13.901</b>	<b>72,006</b>

Source: CDM Smith 2019.

## Section 4

# LGB 2031 BAU Construction Source Emissions Inventory

### 4.1 Construction Emission Documents

In 2031, routine maintenance and minor improvements are expected to occur on and around the Long Beach Airport (LGB). No major construction activity, such as the upcoming Phase II of the LGB Terminal Area Improvements, is anticipated to occur during 2031. For the 2031 BAU emissions inventory, routine construction associated with maintenance and minor improvements was assumed to be comparable in magnitude to the routine construction activities of the 2017 baseline.

Descriptions of routine maintenance and minor airport improvements were provided by the airport and emission estimates were made to account for this activity.

Emissions were calculated using the California Emission Estimator Model (CalEEMod) version 2016.3.2. The model can be accessed at <http://www.caleemod.com/>. CalEEMod emissions were estimated for the following options from the Project Characteristics menu: Los Angeles-South Coast County; CEC Forecasting Zone 9; Urban Land Use; Construction Start date of January 2<sup>nd</sup> 2017; Operational Year of 2021 (default); and no utility company selected.

Four airport-related projects were identified as occurring during 2017: Airport Perimeter Fence Replacement; Lot 'A' Improvements; Keystone Parking Lot Pavement Repair; and Taxiway 'L' Repairs.

- **Airport Perimeter Fence Replacement:** This improvement involved replacement of the airport's existing perimeter fencing with a new 8-foot tall anti-climb fence and fabric as well as security camera and system upgrades. The project occurred between January and August 2017 and was modeled using three overlapping CalEEMod phases: Demolition, Trenching, and Site Preparation.
- **Lot 'A' Improvements:** This improvement involved construction of a new elevator and stair tower, construction of a new vehicle exit, pavement reconstruction of a taxi cab exit lane, and cosmetic upgrades for the parking structure. The project occurred between January and December 2017 and was modeled using four staggered and partially overlapping CalEEMod phases: Building Construction, Demolition, Architectural Coating, and Paving.
- **Keystone Parking Lot:** This maintenance activity involved a minor pavement repair. The project occurred during September 2017 and was modeled using one CalEEMod phase: Paving.
- **Taxiway 'L' Repair:** This maintenance activity involved a minor taxiway pavement repair. The project occurred during March 2017 and was modeled using one CalEEMod phase: Paving.

For each project, an approximate square footage was input into CalEEMod to account for demolition hauling and fugitive VOCs from paving where applicable. The equipment and phases modeled in CalEEMod using the default equipment specification are listed in **Table 13**.

**Table 13. Equipment by Phase**

Project - Phase Name	Offroad Equipment Type	Equipment Count
Perimeter Fence-Demo	Concrete/Industrial Saws	1
Perimeter Fence-Demo	Rubber Tired Dozers	1
Perimeter Fence-Electrical	Tractors/Loaders/Backhoes	1
Perimeter Fence-Electrical	Trenchers	1
Perimeter-Fence-Fence Construction	Tractors/Loaders/Backhoes	1
Perimeter-Fence-Fence Construction	Rough Terrain Forklifts	1
Lot A-Demo	Concrete/Industrial Saws	1
Lot A-Demo	Rubber Tired Dozers	1
Lot A-Demo	Tractors/Loaders/Backhoes	1
Lot A-Improvements	Air Compressors	1
Lot A-Construction	Cranes	1
Lot A-Construction	Forklifts	2
LotA-Construction	Welders	1
Lot A-Paving	Cement and Mortar Mixers	2
LotA-Paving	Pavers	1
LotA-Paving	Rollers	1
Keystone Lot-Construction	Tractors/Loaders/Backhoes	1
Keystone Lot-Paving	Cement and Mortar Mixers	1
Keystone Lot-Paving	Pavers	1
Taxiway L-Construction	Tractors/Loaders/Backhoes	1
Taxiway L-Paving	Cement and Mortar Mixers	1
Taxiway L-Paving	Pavers	1

Source: CDM Smith 2019.

## 4.2 Construction Equipment Emissions Inventory

The emissions inventory for LGB 2031 construction activity is presented in **Table 14**.

**Table 14. LGB 2031 BAU Construction Activity Emissions Inventory**

Construction Source Category	Pollutant Emissions, tons per year						Tonnes
	CO	VOC	NOx	SOx	PM10	PM2.5	CO2
Replacement Airline Passenger Terminal Project	-	-	-	-	-	-	-
Miscellaneous Airport Maint.	2.30	0.36	2.91	<0.01	0.31	0.20	336
<b>Total</b>	<b>2.30</b>	<b>0.36</b>	<b>2.91</b>	<b>&lt;0.01</b>	<b>0.31</b>	<b>0.20</b>	<b>336</b>

Source: CDM Smith 2019